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Macroeconomic determinants of non-performing loans in Mongolia: the influence of currency mismatch and bank size

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Macroeconomic determinants of non-performing loans in Mongolia: the influence of currency mismatch and bank size

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Abstract

Non-performing loans (NPLs) is leading indicator of financial system health. Understanding the determinants of credit quality is essential to conducting stress test and macro prudential policy. The macroeconomic determinants of NPLs have been found to differ between countries and are potentially sensitive to model specification, particularly a mismatch between the loan currency (foreign/domestic) and sector orientation (tradeable/non-tradeable). This paper examines the macro-determinants of NPLs in Mongolia using monthly panel data for 14 banks between December 2003 and December 2019. Using a system GMM approach for the overall sample and subsamples isolating systemically important banks, I find foreign currency loan quality to be more sensitive to macroeconomic variables and big banks more exposed to the currency mismatch problem.

JEL Codes: G21, C23

Keywords: Non-performing loans, Mongolian banking system, currency mismatch, system GMM approach.

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I. Introduction

Since the global financial crisis, there have been extensive studies examining ex-post credit risks. Determinants of NPLs are heterogenous across countries as well as loan types. Many researchers found currency mismatch was an important influence on the total NPLs ratio through the exchange rate, however no prior research has distinguished loan by currency type (foreign and domestic). This study attempts to fill this gap with a Mongolian case study. Since currency mismatch mostly refers to foreign currency loans, this approach better estimates the impacts to provide a clearer idea of effects of lending in foreign currencies to unhedged borrowers. Additionally, differentiating impacts of NPLs by currency will evidence differences between tradeable and non-tradeable sector behaviours, as tradeable sectors are earning and tend to borrow in foreign currency. Macroeconomic variables may impact tradeable and non-tradeable sectors differently. Tradeable sectors tend to be more volatile and affected not only domestic economic situation but also directly related to rest of the world.

This paper focuses on the Mongolian banking system. Mongolia is a natural resource-dependent country. About 90 percent of its exports are commodities. Commodity goods have characteristically volatile prices, which translates to economic volatility in Mongolia. The uncertainty and short period of boom-bust cycles makes the financial sector vulnerable too. The financial sector has suffered through the Asian and global financial crises and almost half of the banks have defaulted since the 1990s. The financial sector is important to economic growth in developing countries like Mongolia, playing an essential role in capital accumulation. So financial stability is crucial for development and it is important to study sources of financial instability. The biggest financial risk is credit risk. So, this research studies the contribution of economic variables to ex post credit risk in NPLs.

This paper is organised as follows. Section II presents the recent developments of NPLs in Mongolia; Section III outlines related theory; Section IV reviews the literature, while Section V describes the econometric methodology. Section VI discusses some data issues and the estimation results and then the final section provides a conclusion.

II. Recent developments in Mongolia's NPLs

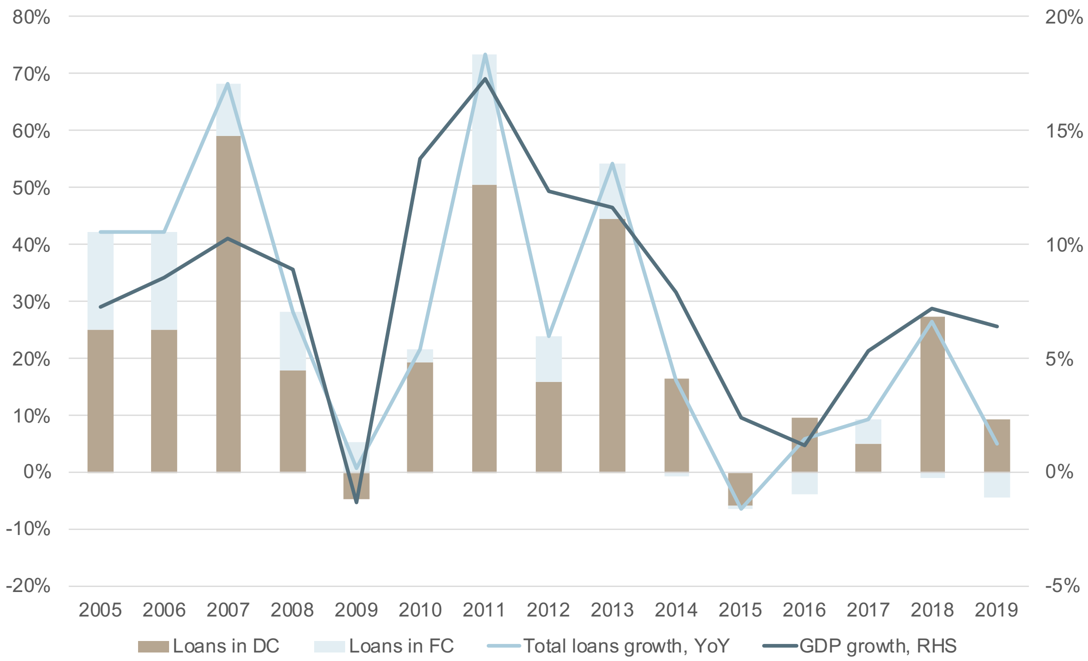
Mongolia's financial system is developing and dominated by commercial banks, holding about 90 per cent of financial assets. The business cycle and financial sector are highly correlated and quite volatile in Mongolia, mainly driven by export prices and FDI (Figure 1, 2).

The ratio of NPLs to total loans in the banking sector has risen since beginning of 2013 (Figure 3) alongside the slowdown of the economy. Specifically, the foreign currency NPLs ratio is increasing faster than for domestic currency, which may relate to exchange rate depreciation.

Banking sector dollarization is high in Mongolia with that about 30 per cent of total deposits and about 20 per cent of total loans consist of foreign currency. However, foreign currency loan is reducing recently, deposit dollarization is still stable. This may indicate a currency mismatch in the banking sector balance sheets. Therefore, differentiating between foreign and domestic currency loans is important to determining the macroeconomic variables influencing NPLs.

Banking concentration is high in Mongolia. For example, more than two-thirds total loans are issued by just 3 out of 14 banks - and this has been the situation since 2003.

Figure 1: Economic growth and outstanding loan growth of banking system by currency type

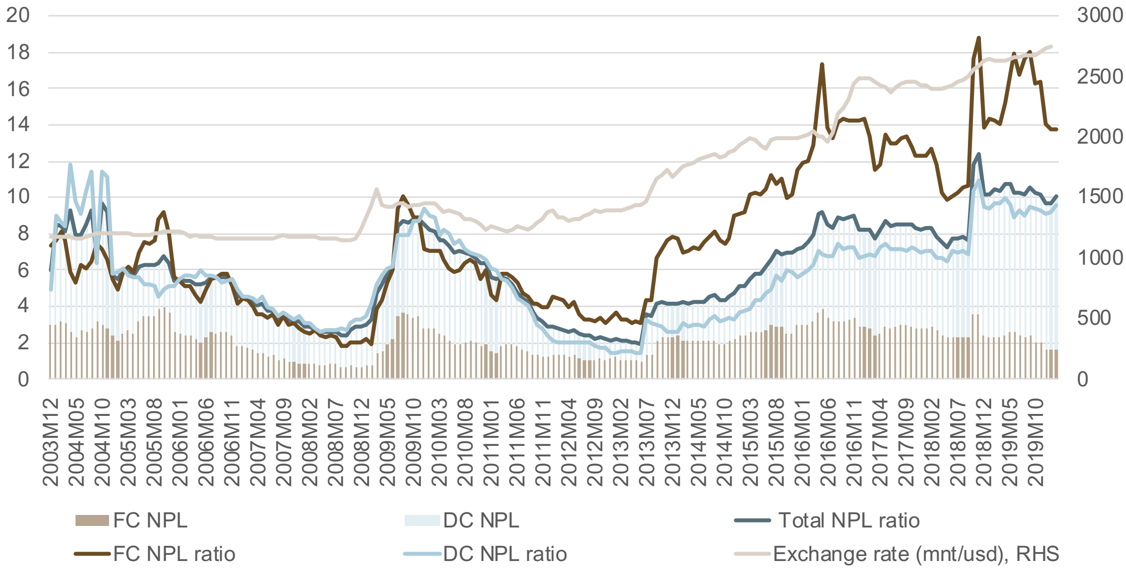


Source: Bank of Mongolia (BOM) and National Statistical Office of Mongolia (NSO)

Figure 2: Economic growth and export price index

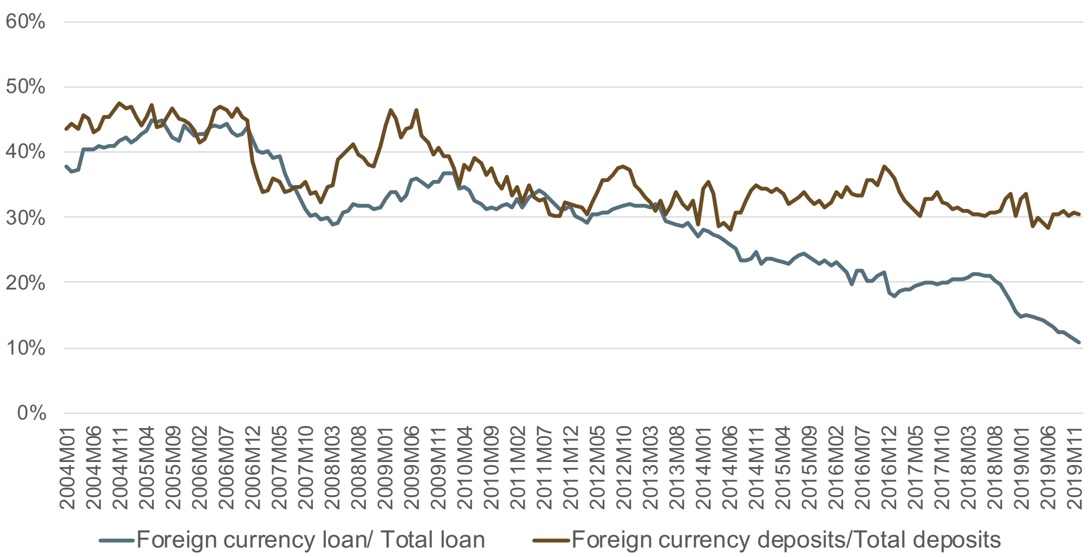
Source: Bank of Mongolia (BOM) and National Statistical Office of Mongolia (NSO)

Figure 3: NPLs ratio by currency type



Source: Banks balance sheets, BOM

Figure 4: Loan and deposits dollarization in banking system



Source: Banks balance sheets, BOM

III. The life-cycle model with consumer default

The theoretical relationship between NPLS and macroeconomic variables is relatively less studied and focused on explaining consumer default through the life cycle consumption model (Lawrence 1995) and it is extension to investment (Rinaldi & Sanchis-Arellano 2006). The basic model will be explained first before adding risk to incorporate consumer default into the system. Investment options will then be added to the consumer optimisation problem.

Under a simple two-period model, consumers maximise their lifetime utility by allocating consumption across periods according to:

$$V(C_1, C_2) = U(C_1) + \tfrac{1}{1+\delta} E[U(C_2)] \quad (1)$$

Where C_i – consumption in period I, δ is time preference and E donates expectations. The utility function satisfies Inada conditions and future income is uncertain. Consumption is financed by income (Y_i) and borrowing (x_i). It is assumed that consumers can borrow freely with exogenous risk-free interest rate (R). If consumers borrow x_1 units in period one, then their consumption will be $x_1(1+R)$ units lower in period two. In order words, savers give up x_1 units of consumption in period one while borrowers sacrifice $x_1(1+R)$ unit of consumption in period two. To model future income uncertainty, the probabilities of having high or low income are introduced. Q is probability of having low income while 1-q is probability of having low income in period 2.

The utility maximising problem with borrowing and future income uncertainty can be expressed as:

$$V(x_1, x_2) = U(Y_1 + x_1) + \frac{1}{1+\delta}[qU(Y_L + x_2) + (1-q)U(Y_H + x_2)] \quad (2)$$

Subject to $x_2 = x_1(1+R)$ (3)

Optimal level will occur when the marginal rate of substitution of current consumption for future consumption equals $(1+R)$.

$$MRS = \frac{(1+\delta)U'(Y_1 + x_1)}{qU(Y_L + x_2) + (1-q)U(Y_H + x_2)} = 1 + R, \quad (4)$$

Perfect capital markets are assumed, which means there is no risk of default.

Introducing the risk of default, q is per cent of probability that banks face no repayment. It is assumed that bank repayments are equal to the amount of the loan (Y_L) plus interest. In this case, interest (r) will be included in the risk premium (rp) which is charged based on the collateral, chance of default and general economic conditions.

$$1 + r = (1 + R)(1 + rp) \tag{5}$$

$$(1 + rp) = \frac{1}{1 - q} \tag{6}$$

(6) states how banks determine the price. Banks maximum amount to lend is b_{max}.

$$b_{max} = \frac{1}{1 + r}(Y_H - Y_L) \tag{7}$$

Borrowers that default will give up x_2 units of consumption with probability (1-q).

Loans could be used for investment not only for consumption. In this case, the chance of default also depends on net wealth in period 2. Introducing investment, the interest rates will be different, depending on return of the investment and risks. Additionally, in the short run, misalignments in the pricing of assets could influence the risks.

The utility maximising problem can be changed to equation 8.

$$V(x_1, x_2) = U(Y_1 - I_1 + x_1) + \frac{1}{1 + \delta}[qU(Y_L + x_2) + (1 - q)U((Y + I)_H + x_2)] \tag{8}$$

$$\text{Subject to } x_2 = -(1 + r)x_1 \tag{9}$$

Optimisation satisfies the condition in equation 10. This defines optimal loan size given q probability of default.

$$MRS_B = \frac{(1 + \delta)U'(Y_1 - I_1 + x_1)}{(1 - q)U'((Y + I)_H + x_2)} = 1 + r, \tag{10}$$

From equation 10, the probability of default is defined as:

$$q = \frac{(1 + r)U'[(Y + I)_H + x_2] - (1 + \delta)U'(Y_1 - I_1 + x_1)}{(1 + r)U'[(Y + I)_H + x_2]} \tag{11}$$

Where $1 + r = (1 + R)(1 + rp)$ and $x_2 < 0, x_1 > 0$.

Equation 11 states that the probability of default is affected by size of the loan (x_1), current income (Y_1) and investment (I_1), bank lending rate (r). Additionally, it depends on the future or uncertain income and wealth, usually reflects employment possibility; asset prices and time preference (δ), related to inflation expectation. Better income will reduce the probability of default while higher lending interest rate increases the probability of default. If the investment efficient, it will increase next period income and lead to better loan quality. When the rate of preference is higher, the probability of default will be lower. If considering as increasing inflation, it reduces the real value of outstanding loan, but at the same time it reduces the real income of individuals whose wages are generally sticky. Moreover, lower inflation and less volatile prices lead to less economic uncertainty and better quality of loans. So, the inflation effect is ambiguous.

IV. Empirical literature

Compared to the limited theoretical studies, empirical studies have been conducted extensively; particularly after financial crises. Macroeconomic impacts on NPLs are different among literatures. Studies have considered a wide range of macroeconomic impacts on NPLs, including exchange rate, public debt, housing price index and capital inflow. Country-specific and disaggregated impacts have also been extensively researched, for example, estimating for aggregate NPLs, separately by economic sector classification, economic agents, and banks. Moreover, different outcomes are from the type of data, sample period and specification (Chortareas, Magkonis & Zekente 2020).

The empirical analyses are being mostly included base variables driven from the theoretical model such as GDP, unemployment, inflation, interest rate and asset prices; and added other macroeconomic variables mostly depending on countries' economic development. For example, the specific variables are public debt (Ghosh 2015), housing price and starts (Ghosh 2017) in the US; public debt in Greek case (Louzis, Vouldis & Metaxas 2012); external debt, current account deficit (Kauko 2012), exchange rate (Buncic & Melecky 2013), unanticipated macro shocks and financial fragility (Pesola 2011) in selected EU countries; housing price, exchange rate and public debt for GIPSI (Castro 2013); exchange rate, terms of trade (TOT), variables related with capital flows for Emerging economies (De Bock & Demyanets 2012; Kuzucu & Kuzucu 2019). For the cross-country analysis, exchange rate impacts additionally to the base variables (Beck et al. 2015). For the methodology, basically two kinds of approach are used based on panel data. Those are general method of moment (GMM) estimators for dynamic panel data and VAR to deal with endogeneity problem, however first method is most used.

The variables most commonly found to affect NPLs are public debt and exchange rates. In the empirical studies found higher debt level and depreciating exchange rate worsen the loan quality. Because, the higher the public debt, the higher the risk of increasing tax and decreasing incomes needed to service loans. Moreover, the high debt level can destabilise the economy and in turn reduce employment. Meanwhile a depreciating exchange rate can lead to higher pressure to repay foreign currency debt, particularly for non-tradable sectors. A weaker local currency creates banking system vulnerability for several reasons (Dornbusch et al. 1995; Krugman 1999). The first relates to exchange rate regulation and regime. If the exchange rate is overvalued or tightly managed, exchange rate pegs are likely to collapse during the economic downturn because of limited foreign exchange reserves (Beck et al. 2015; Hausmann et al. 2001). Secondly, unhedged loans and balance sheets of the banks against the foreign currency changes. Foreign currency loan borrowers without foreign currency income and hedging are heavily impacted by currency depreciation (De Bock & Demyanets 2012, p.7). On the other hand, exchange rate depreciation can lead to higher export revenue that could positively affect repayments by the tradeable sector. Therefore, examining the determinants of NPLs by foreign and domestic currency loan separately will provide clear explanation which are dominating of those impacts. Besides, it could be specified differences in sensitivity of tradeable and non-tradeable sector on NPLs. Because tradeable sectors are earning and tend to lend by foreign currency. Macroeconomic variables may impact differently in tradeable and non-tradeable sectors NPLs. Tradeable sectors tend to more volatile and affected not only domestic economic situation but also directly related to rest of the world. Some studies emphasise the differing sensitivity among different types of loan (Louzis et.al 2012); economic activity (Vazquez et.al 2012) and banks (Grigoli et.al 2018), not the currency types.

For emerging economy, higher capital inflow or TOT can decrease the NPLs. According to De Bock and Demyanets (2012), while banks' balance sheets are impacted by TOT, its relationship with exchange rate is not certain. TOT is the main cause of balance of payment crises and then banking crises. Improvement of term of trade and higher capital inflow stimulate economic activity, so it will reduce the NPLs.

Apart from the macroeconomic variables, some researchers added bank specific variables into their estimations. These include return on assets, bank size, solvency ratio, leverage ratio and cost inefficiency (Ghosh 2015; Louzis et.al 2012).

Mongolian case, there is limited studies conducted, particularly for macroeconomic impacts of banking system has not been studied. Ganbaatar and Selenge (2012) studied NPLs determinants for individual banks by regression analysis and found that the big banks are affected GDP negatively while the small banks effect of GDP is opposite direction.

V. The econometric methodology

The GMM estimator for banks dynamic panel data is used to define impacts of macroeconomic variables on NPLs in Mongolia. The GMM estimator is a widely used econometric technique for dynamic equations with one dependent variable and is useful in dealing with endogeneity as well as time fixed effects. NPLS ratios are dynamic in nature, as it is a stock variable influenced by past values and of relevance of future financial condition, while also influencing contemporaneous bank lending policy and thus the future NPLs ratio (Rinaldi & Sanchis-Arellano 2006, p.19).

The econometric approach is flexible in terms of error term allowing for arbitrary autocorrelation and heterogeneity within panels. This approach is specifically suitable for panel data covering a small number of periods, as the fixed effect OLS estimator is biased and inconsistent for small samples. Also, the GMM estimator is theoretically efficient (Roodman 2009).

The basic model is:

$$y_{i,t} = \alpha y_{i,t-1} + \mathbf{X'}_{it}\boldsymbol{\beta} + v_{it} \tag{12}$$

$$v_{i,t} = \mu_i + \varepsilon_{i,t} \tag{13}$$

$$E[\mu_i] = E\left[\varepsilon_{i,t}\right] = E\left[\mu_i \varepsilon_{i,t}\right] = 0 \tag{14}$$

Where μ_i – panel specific fixed effect, ε_{it}- random shock.

Fixed effects in disturbance term make y_{it-1} endogenous. Individual dummies or within group transformation do not help solve endogeneity, as transformed y_{it-1} is endogenous, as are deeper lags. This is a problem of small number of periods (Roodman 2009).

$$y_{i,t} = y_{i,t-1} - \left\{\frac{1}{T-1}\right\}(y_{i,2} + \cdots + y_{i,T}) \tag{15}$$

$$v_{i,t} = v_{i,t-1} - \left\{\frac{1}{T-1}\right\}(v_{i,2} + \cdots + v_{i,T}) \tag{16}$$

where $y^*_{i,t-1}$ and $v^*_{i,t-1}$ correlated unless $T \rightarrow \infty$.

In the absence of external instruments, internal instruments can be used. In that case, difference GMM (Arellano & Bond 1991) or system GMM method (Arellano & Bover 1995) is useful. If taking first-difference (17),

$$\Delta y_{i,t} = \alpha \Delta y_{i,t-1} + \Delta \mathbf{X}'_{it}\boldsymbol{\beta} + \Delta v_{it} \tag{17}$$

Where $\Delta v_{it} = \Delta \varepsilon_{it}$

$\Delta y_{i,t-1} = y_{i,t-1} - y_{i,t-2}$ correlates with $\Delta v_{i,t-1} = v_{i,t-1} - v_{i,t-2} = \varepsilon_{i,t-1} - \varepsilon_{i,t-2}$. So, it brings a bias in the estimation. But, deeper lags, for example $y_{i,t-2}$ can be used as an instrument of the equation 17 if there is no autocorrelation in errors. Because $y_{i,t-2}$ is mathematically correlated with $\Delta y_{i,t-1}$, but not correlated with $\Delta \varepsilon_{it}$ for t=3…T. Thus, the benefit of using this approach is that it does not need any external instruments but uses lagged values as internal instruments. The assumption of no autocorrelation in errors must be checked so there is no second order serial correlation in the errors.

However, it is complex, and model is sensitive to specifications. If y is nearly a random walk, $y_{i,t-2}$ is a poor instrument for $\Delta y_{i,t-1}$, despite the mathematical relationship. In that case, finding instruments orthogonal to them, instead of purging fixed effects (Arellano & Bover 1995). Also, system GMM, making system of difference and level equations can be used when there is concern about weak instruments. The instrument for the difference equation is the lagged level variable and vice versa. Another problem arises from over specifying the model using too many instruments. The Hansen test was used to determine instrument validity.

VI. Empirical analysis

The macroeconomic variables chosen for the model were based on the earlier considered theoretical and empirical literature as well as Mongolian economic conditions. These were GDP, inflation, interest rate, exchange rates, TOT, net capital inflow and fiscal expenditure. GDP is in real domestic currency and inflation is measured by CPI for Ulaanbaatar city due to data availability. Policy interest rates were chosen because it is the benchmark rate for lending as well as deposit rate. For capturing fiscal policy, fiscal expenditure is used due to the data availability. Open economy variables -TOT and net capital inflows - are also included because of Mongolia's economic structure. The dependent variable is the ratio of NPLs to total loans outstanding. Bank size is chosen to proxy the bank specific effects since other variables such as solvency ratio, return on equity and leverage ratio are too volatile to estimate. Unemployment is not included because the data in Mongolia is quite volatile and not reliable. Stock market is on its infant stage in Mongolia, so stock market or asset price is also not added in the estimations.

6.1 The data

The study employs balanced panel data consisting of 14 banks between 2003M12 and 2019M12 with the permission of Bank of Mongolia. All macroeconomic variables are available for monthly basis except GDP data, which is quarterly. So, GDP data is converted into monthly by Boot-Feibes-Lisman method, one of the common methods to disaggregate macroeconomic time series.

All variables are in log form except NPLS ratios and policy interest rates and all are seasonally adjusted by X-13ARIMA approach. The description of the variables and sources are illustrated in Appendix 1. Variables are quite volatile, so outliers, lowest and highest 10 per cent of the data are removed if there are outliers in the variables (Appendix 2).

6.2 The estimation results

Lags of the macroeconomic variables applied because downgrading loan quality requires several steps and some time. Lags of GDP, inflation, interest rate, TOT are three months or one quarter while the lags of net foreign capital for domestic currency and fiscal expenditure are six months or two quarters. The reason of that lags of net foreign capital for domestic currency equation and fiscal expenditure are deeper is that their influences on the business activity are lagged. Considering balance sheet effects of the exchange rate, no lag applied to this variable.

As banking is highly concentrated in Mongolia, subsample analyses for big banks and other banks (excluding defaulted banks) were conducted. The reason is big banks and small banks may have different behaviours. Four banks are classified as a big bank and they issued 78 percent of total loans on average. Excluding three defaulted banks, seven banks are grouped in the other banks.

For robustness, fixed effect estimation results compared, and estimation results are generally robust. Tests for AR(2) and Hansen tests have passed for all models. Taking to account standard deviations of the variable quite high; at the maximum, 15 per cent significance level is accepted.

6.2.1 Estimations for domestic currency NPLS

Banking system: All estimation results are presented in table 2. For the banking system, all variables are significant. GDP has negative impact on domestic currency NPLs with one quarter lag. Slowing down the economy leads unanticipated decline in income and unemployment for some individuals and then brings difficulties to repay NPLs. On average, if the GDP decline by 1 percent, banking system domestic currency NPLs ratio will increase by about 6 percentage point in a quarter holding other things constant.

Higher inflation is also found to increase the NPLs ratio according to the estimation. Theoretically, the inflation impact should be ambiguous. When inflation increases, it reduces the real value of outstanding loan, but at the same time it reduces the real income of individuals whose wages are generally sticky. Moreover, lower inflation and less volatile prices lead to less economic uncertainty and better quality of loans (Rinaldi & Sanchis-Arellano 2006). In Mongolian case, inflation is relatively high and volatile, so it not only reduces the real income of individuals but also creates uncertainty. One percentage point higher inflation is associated with a 3.5 percentage point increase in the NPLs with one quarter lag.

The domestic currency NPLs is negatively related to policy interest rate. Theoretically, if the lending the rate increases, loan quality will worsen. However, in Mongolian case, tighten monetary policy will contribute less uncertainty, so then better outcome of the loan quality rather than its effect of lending rate. For example, during the economic booming period in 2011s, there were overheating in credit growth reaching around 70 per cent, which may be reduced by increase in the policy interest rate. Such overheating in credit market drives higher risk, therefore the policy rate will help to reduce that risk as well as uncertainty of economy during the booming period.

On the contrary, looser fiscal policy will not help to improve loan quality in the estimation for banking system. However, it is not robust since it is not significant for both subsample estimation.

Exchange rate depreciation worsens loan quality. This may relate to the reduced purchasing power of individuals. In Mongolia, about 20 per cent of consumer basket good is made up of imported goods. Also, about 30 per cent of intermediate goods are imported (NSO 2018). So, it negatively affects ability to repay the loan. Expecting exchange rate movement is hard in Mongolia related with its mining sector dependency. The elasticity is equal to 1.54.

Unexpected increase in net capital inflow or terms of trade can decrease the NPLS. According to De Bock and Demyanets (2012), while banks' balance sheets are impacted by TOT, its relationship with exchange rate is not certain. TOT is the main cause of balance of payment crises and then banking crises. Improvement of term of trade and higher capital inflow stimulate economic activity, so it will reduce the NPLs. The elasticity of net capital inflow is -0.54 while that of TOT is -0.29.

Bigger the bank, the lower the NPLs ratio has. From the data, the small banks NPLs has high level and standard deviations. The small banks tend to be less diversified and more vulnerable. If a bank has 1 percentage point higher share of loan to the total loan, they have 0.04 percentage point better NPLS ratio than the others.

Big banks vs other banks: Domestic currency NPLs ratios of big banks are dependent on GDP, exchange rate and interest rate while that of other banks are related to GDP, CPI, interest rate and net capital inflow.

Big banks have less sensitive with GDP and much higher sensitivity of exchange rate.

6.2.2 Estimations for foreign currency NPLs

Banking system: All variables are significant and consistent with the estimation for domestic currency NPLs ratios except net capital inflow. Net capital inflow is positively affected on foreign currency NPLs ratio. This may because the lenders by foreign currency are highly likely to be from tradeable sector and borrow from overseas; hence their loan burden will increase if they are borrowing from abroad additionally.

The magnitudes of the coefficients for all variables are higher, which implies tradeable sector loan quality is more sensitive to the macroeconomic variables.

Additionally, the higher exchange rate impact might be related to currency mismatch.

Big banks vs other banks: Big banks foreign currency loan quality depends on open economy variables, such exchange rate, TOT and bank size while, in other banks, domestic economy variables, GDP, interest rate as well as open economy variables, net capital inflow, tot and bank size are significant on foreign currency loan NPLs ratio. Coefficient of bank size is positive for big banks, which means if banks are becoming too big and then risks are increasing. Reversely, if banks are too small, the vulnerability is high too, which can be seen from the estimation of other banks. Another considerable difference is that big banks may face more about currency mismatch problem by having significant effect of exchange rate.

6.2.3 Estimations for total NPLs

Banking system: GDP, exchange rate, interest rate, net capital inflow and bank size explains variations of total NPLS ratio significantly. Current net capital inflow influences positively whereas 2 quarter lags of that has negative effect on total NPLs ratios. But the net impact is positive, in order word, foreign debt burden outweigh its positive impacts of business activity. This may be explained by that the external loan is increasing significantly over the years.

Big banks vs other banks: Overall NPLs ratios in big banks is affected by again open economy variables, exchange rate, TOT and net capital inflow. Rest of the bank's loan quality is caused by both of domestic economy and open economy variables, which are GDP, net capital inflow and TOT.

Table 2: Estimation results

	System GMM estimators									Fixed effects estimators								
	All banks			Big banks			Other banks'			All banks			Big banks			Other banks'		
	Domestic	Foreign	Total	Domestic	Foreign	Total	Domestic	Foreign	Total	Domestic	Foreign	Total	Domestic	Foreign	Total	Domestic	Foreign	Total
NPL(-1) (percent)	__0.82***__ (0.06)	__0.94***__ (0.04)	__0.81***__ (0.06)	__0.55***__ (0.09)	__0.80***__ (0.07)	__0.58***__ (0.12)	__0.79***__ (0.10)	__0.95**__ (0.04)	__0.82***__ (0.06)	__0.90***__ (0.01)	__0.94***__ (0.01)	__0.91***__ (0.01)	__0.87***__ (0.02)	__0.90***__ (0.02)	__0.90***__ (0.02)	__0.90***__ (0.01)	__0.95***__ (0.01)	__0.89***__ (0.02)
GDP(-3) (log)	__-6.27***__ (0.90)	__-7.94**__ (3.44)	__- 4.40***__ (2.03)	__-1.58*__ (0.95)	-1.79 (3.48)	0.05 (2.43)	__-8.54**__ (3.58)	__- 12.62***__ (4.85)	__-5.20*__ (3.35)	__-5.06***__ (1.14)	__-6.7**__ (2.63)	__- 3.78***__ (1.29)	__-1.98**__ (0.98)	-1.16 (1.62)	-0.17 (0.90)	__-6.57***__ (1.82)	__- 12.81***__ (4.51)	__- 5.25***__ (2.01)
Exchange rate (log)	__1.54**__ (0.64)	__3.92*__ (2.44)	__3.03*__ (1.55)	__6.46***__ (1.98)	__2.53*__ (1.50)	__6.51***__ (1.51)	1.14 (1.29)	3.29 (2.41)	3.09 (2.36)	0.83 (0.65)	__3.21*__ (1.47)	__2.65***__ (0.83)	__1.68***__ (0.65)	__1.41*__ (0.92)	__1.72***__ (0.67)	0.80 (1.04)	2.51 (2.54)	__3.48***__ (1.27)
CPI(-3) (log)	__3.50**__ (1.66)	__3.56*__ (2.20)	1.43 (1.66)	-1.74 (1.63)	1.95 (3.08)	-2.14 (2.23)	__6.03**__ (3.06)	__8.73***__ (2.92)	2.76 (2.91)	__3.32***__ (1.19)	3.51 (2.75)	0.61 (1.27)	-1.25 (1.04)	1.28 (1.67)	-0.22 (0.91)	__5.05***__ (1.90)	__8.25*__ (4.63)	1.63 (1.96)
Interest rate(-3)	__-0.08***__ (0.02)	__- 0.13***__ (0.05)	__-0.06*__ (0.04)	__-0.08*__ (0.04)	-0.06 (0.08)	0.015 0.03	__-0.07*__ (0.04)	__-0.22***__ (0.08)	-0.20 (0.09)	__-0.05**__ (0.03)	__-0.11*__ (0.062)	__-0.05*__ (0.03)	__-0.03*__ (0.02)	-0.03 (0.04)	0.01 (0.02)	-0.04 (0.04)	__-0.21**__ (0.10)	__-0.08*__ (0.04)
Net capital inflow (log)		__1.68***__ (0.71)	__1.75**__ (0.78)		0.24 (0.54)	__0.61*__ (0.40)		__1.74***__ (0.99)	__2.45*__ (1.28)		__1.31*__ (0.74)	__1.64**__ (0.38)		0.52 (0.44)	__0.49*__ (0.26)		1.61 (1.28)	__2.69***__ (0.58)
Net capital inflow(-6) (log)	__-0.54**__ (0.22)		__-0.41*__ (0.28)	-0.01 (0.11)		-0.30 (0.22)	__-0.56***__ (0.16)		-0.21 (0.24)	__-0.39__ (0.31)		-0.20 (0.34)	-0.03 (0.3)		0.19 (0.24)	-0.15 (0.50)		0.11 (0.52)
TOT(-3) (log)	-0.29 (0.49)	__-1.10*__ (0.71)	-0.70 (0.60)	-0.44 (0.85)	__- 1.55***__ (0.37)	__-0.87*__ (0.55)	-0.70 (1.16)	__-1.91*__ (0.94)	__-1.75*__ (1.09)	-0.14 (0.37)	__-1.56*__ (0.88)	__0.79*__ (0.41)	-0.11 (0.73)	__-1.07**__ (0.53)	__-0.46*__ (0.31)	-1.19 (0.58)	__-2.79*__ (1.48)	__-1.31**__ (0.61)
Fiscal expenditure (-6) (log)	__0.80*__ (0.36)	__0.94*__ (0.55)	0.49 (0.55)	-0.32 (0.38)	-0.09 (0.17)	__0.06*__ (0.38)	0.60 (0.64)	-0.84 (0.94)	0.28 (0.69)	__0.55*__ (0.31)	0.88 (0.67)	__0.69**__ (0.33)	-0.08 (0.28)	0.03 (0.42)	-0.13 (0.24)	0.35 (0.48)	__1.59*__ (1.11)	0.55 (0.50)
Bank size (percent)	__-0.04*__ (0.02)	__-0.05*__ (0.02)	__-0.05**__ (0.02)	-0.02 (0.04)	__0.08***__ (0.01)	0.00 (0.03)	-0.24 (0.20)	__-0.24**__ (0.12)	-0.22 (0.20)	-0.03 (0.03)	-0.09 (0.07)	-0.02 (0.04)	-0.02 (0.02)	-0.04 (0.04)	0.01 (0.02)	-0.09 (0.11)	-0.28 (0.23)	-0.09 (0.10)
Observation	1540	1534	1255	496	586	392	796	743	661	1540	1534	1255	496	586	392	796	743	661
Test for AR(2): p value	0.76	0.93	0.43	0.12	0.15	0.27	0.45	0.33	0.70	Adjusted R2/ within								
Hansen test: p value	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.84	0.89	0.83	0.89	0.87	0.91	0.82	0.90	0.82

Notes: values in the brackets indicate standard errors, ***denote significance at 1 per cent, ** denote significance at 5 per cent, denote significance at 15 per cent

VII. Conclusion

In this study, the empirical analyses are conducted to define determinants of NPLs in the Mongolian banking sector. Apart from that, the contribution of the paper is to identify difference between NPLs by currency type.

Generally, macroeconomic variables, GDP, exchange rate, interest rate, net capital inflow, tot, and a bank specific variable, bank size are impacting the NPLs, but it is different for currency type of loan as well as a banks type, big or not.

The quantitative impacts on foreign currency NPLs ratio is higher than the domestic currency NPLs ratio, which might imply tradeable sectors loan quality is more sensitive to the macroeconomic condition than the non-tradeable sector. Additionally, the impact exchange rate on foreign currency loan is higher because of the currency mismatch problem. Another difference is associated with net capital inflow. The variable improves domestic currency loan through better business activity; however, it has negative effect on foreign currency loan, this may relate to external debt burden on borrower, who is highly likely from tradeable sector.

Big banks have different behaviour in Mongolia, specifically for foreign currency NPLs ratio is dependent on more open economy variables while that of small banks is explained by both of open economy and domestic economy variables. Big banks are struggling with currency mismatch problem with have strong significant effect of exchange rate on their foreign currency NPLs ratio.

The results can be used for forecasting NPLs and macro-stress testing in Mongolian banking sector. Particularly, it would be useful to implement actions against increasing foreign currency loan NPLs. In addition, the analyses enable to exercise by bank types systematically important or not, which enhances the reliability of the results as well as useful to assess optional policy actions for the bank types.

Further improvements would be defining determinants of NPLs for not only loan currency type but also economic sector, that could give another detailed insight of loan quality.

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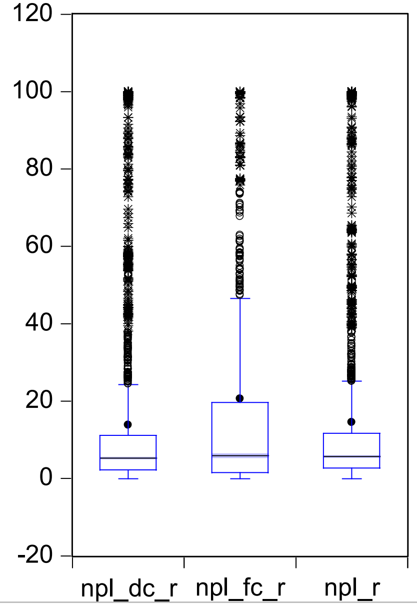
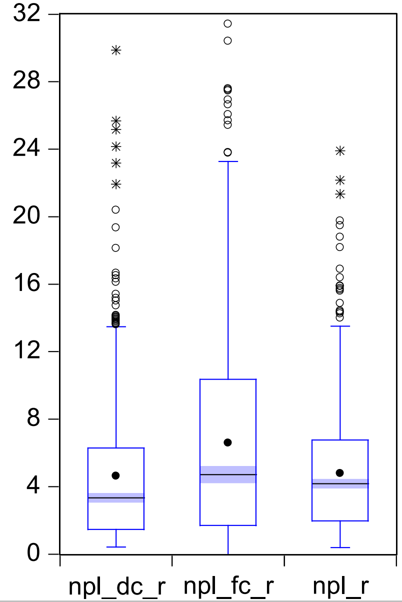
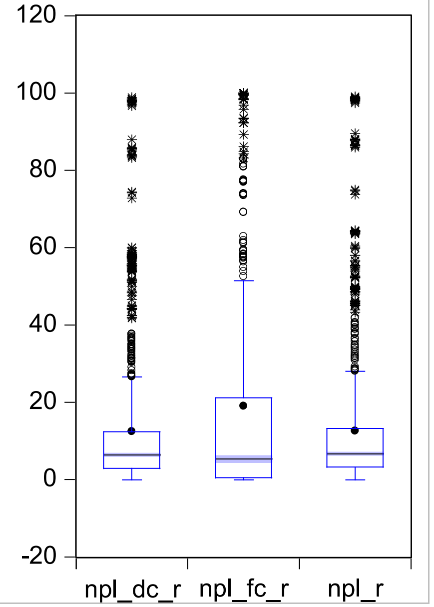
Appendix

1. Variables' description and source

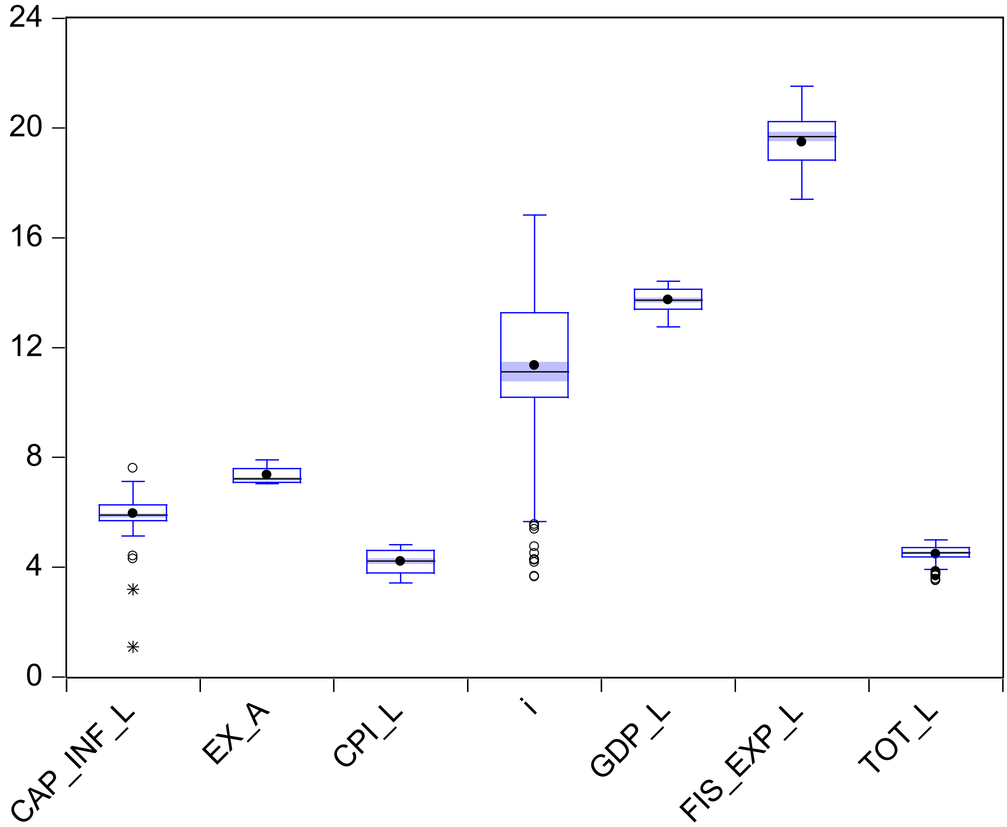
Name	Description	Source
NPLs_r	Ratio of total NPLS and total loan outstanding; percent	Banks balance sheet, Bank of Mongolia (BoM)
NPLs_dc_r	Ratio of domestic currency NPLS and domestic currency outstanding; percent	Banks balance sheet, (BoM)
NPLs_fc_r	Ratio of foreign currency NPLS and foreign currency outstanding; percent	Banks balance sheet, (BoM)
Bank_size	Bank size defined by ratio of a bank loan to the total banking system loan; percent	Banks balance sheet, (BoM)
gdp_l	Log of real GDP in domestic currency	National Statistical Office of Mongolia (NSO)
cpi_l	Log of CPI index for Ulaanbaatar	NSO
i	Policy interest rate	Monthly bulletin, Bank of Mongolia (BoM)
ex_a_l	Log of nominal average exchange rate (MNT/USD)	BoM
fis_exp_l	Log of fiscal expenditure	Monthly government budget balance, Ministry of finance in Mongolia
cap_inf_l	Log of net capital inflow. Since net capital inflow in Mongolia is not always positive, the number is added to all series to be positive for log transformation.	BoM
Tot	Log of term of trade	BoM

2. Descriptive statistics of the variables

2.1 NPLS variables

	All banks			Big banks			Other banks/excluding 3 defaulted banks/		
	NPLS_R	NPLS_FC_R	NPLS_DC_R	NPLS_DC_R	NPLS_FC_R	NPLS_R	NPLS_DC_R	NPLS_FC_R	NPLS_R
Mean	14.09	20.14	14.01	12.51	19.12	12.68	4.63	6.59	4.80
Median	5.83	5.96	5.50	6.59	5.50	6.87	3.37	4.75	4.20
Maximum	100.00	100.00	100.00	98.93	100.00	99.15	29.87	31.44	23.92
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.00	0.39
Std. Dev.	23.21	31.37	23.52	17.06	29.78	16.91	4.12	6.17	3.55
Skewness	2.78	1.82	2.69	2.74	1.86	2.86	1.75	1.24	1.46
Kurtosis	9.86	4.82	9.35	11.21	5.13	12.07	7.56	4.16	6.32
Observations	2488	2488	2488	1214	1214	1214	780	780	780
Boxplots									

2.2 Macroeconomic variables

	Macro variables						
	CAP_INF_L	EX_A_L	CPI_L	I	GDP_L	FIS_EXP_L	TOT_L
Mean	5.96	7.36	4.22	11.36	13.74	19.50	4.48
Median	5.92	7.24	4.25	11.15	13.75	19.72	4.55
Maximum	7.60	7.91	4.83	16.83	14.42	21.52	4.99
Minimum	1.10	7.04	3.43	3.65	12.76	17.41	3.51
Std. Dev.	0.59	0.29	0.43	2.96	0.42	0.96	0.32
Skewness	-3.24	0.58	-0.31	-0.50	-0.26	-0.43	-1.09
Kurtosis	27.84	1.80	1.73	3.06	2.07	2.16	3.64
Observations	193	193	193	193	193	193	193
Box plots							

3. Estimation results

3.1 Domestic currency NPLS system GMM estimation results for all banks

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1540
Time variable : t                               Number of groups   =        14
Number of instruments = 200                     Obs per group: min =        37
Wald chi2(9)  =    631.33                                      avg =    110.00
Prob > chi2   =     0.000                                      max =       151
```

npl_dc_r_sa_trm	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
npl_dc_r_sa_trm						
L1.	.8237227	.0926975	8.89	0.000	.6420389	1.005406
gdp_l_sa						
L3.	-6.269784	1.892135	-3.31	0.001	-9.9783	-2.561268
ex_a_sa	1.545155	.6402753	2.41	0.016	.2902385	2.800072
cpi_sa						
L3.	3.508041	1.659724	2.11	0.035	.2550426	6.76104
i_sa						
L3.	-.0787904	.0249471	-3.16	0.002	-.1276858	-.0298949
cap_inf_l_sa_trm						
L6.	-.5423108	.2178628	-2.49	0.013	-.969314	-.1153075
tot_sa						
L3.	-.2920669	.4925038	-0.59	0.553	-1.257357	.6732227
fis_exp_l_sa						
L6.	.8010346	.4898125	1.64	0.102	-.1589804	1.76105
size_sh_sa	-.0430109	.0231652	-1.86	0.063	-.0884138	.002392
_cons	51.49628	19.91552	2.59	0.010	12.46257	90.53

```
Instruments for first differences equation
  Standard
    D.(L6.cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa
    L3.cpi_sa L3.i_sa size_sh_sa)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/194).(L2.npl_dc_r_sa_trm L3.npl_dc_r_sa_trm) collapsed
Instruments for levels equation
  Standard
    L6.cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa
    L3.cpi_sa L3.i_sa size_sh_sa
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L2.npl_dc_r_sa_trm L3.npl_dc_r_sa_trm) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.70  Pr > z =  0.007
Arellano-Bond test for AR(2) in first differences: z =  -0.31  Pr > z =  0.758
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(190)  = 207.45  Prob > chi2 =  0.183
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(190)  =   3.28  Prob > chi2 =  1.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(188)  =   2.79  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(2)    =   0.49  Prob > chi2 =  0.783
  iv(L6.cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa L3.i_sa size_sh_sa)
    Hansen test excluding group:     chi2(182)  =   2.13  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(8)    =   1.15  Prob > chi2 =  0.997
```

.

3.2 Domestic currency NPLS fixed effects estimation results for all banks

```
Fixed-effects (within) regression               Number of obs      =      1540
Group variable: id                              Number of groups   =        14

R-sq:  within  = 0.8361                         Obs per group: min =        37
       between = 0.9954                                        avg =     110.0
       overall = 0.8874                                        max =       151

                                                F(9,1517)          =    859.75
corr(u_i, Xb)  = 0.3902                         Prob > F           =    0.0000

------------------------------------------------------------------------------------
npl_dc_r_sa_trm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------------+-------------------------------------------------------------------
npl_dc_r_sa_trm |
            L1. |   .9063104    .010592    85.57   0.000     .8855339    .9270869
                |
      gdp_l_sa  |
            L3. |  -5.055782   1.144366    -4.42   0.000    -7.300489   -2.811074
                |
       ex_a_sa  |   .8280107   .6549062     1.26   0.206    -.4566067    2.112628
                |
        cpi_sa  |
            L3. |   3.320896   1.190185     2.79   0.005     .9863127    5.655479
                |
          i_sa  |
            L3. |  -.0531122   .0255808    -2.08   0.038    -.1032897   -.0029347
                |
cap_inf_l_sa_trm|
            L6. |  -.3911704   .3108179    -1.26   0.208    -1.000849    .2185079
                |
        tot_sa  |
            L3. |  -.1437545   .3748782    -0.38   0.701    -.8790888    .5915799
                |
   fis_exp_l_sa |
            L6. |   .5471463   .3087077     1.77   0.077    -.0583928    1.152685
                |
    size_sh_sa  |   -.033546   .0333549    -1.01   0.315    -.0989726    .0318806
         _cons  |   43.28785   11.50403     3.76   0.000     20.72237    65.85333
----------------+-------------------------------------------------------------------
       sigma_u  |  .39454094
       sigma_e  |  2.2601728
           rho  |  .02957091   (fraction of variance due to u_i)
------------------------------------------------------------------------------------
F test that all u_i=0:     F(13, 1517) =     2.35            Prob > F = 0.0041

.
```

3.3 Foreign currency NPLS system GMM estimation results for all banks

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1534
Time variable : t                               Number of groups   =        14
Number of instruments = 202                     Obs per group: min =        30
Wald chi2(9)  =   5474.40                                      avg =    109.57
Prob > chi2   =     0.000                                      max =       151
----------------------------------------------------------------------------------
                 |               Robust
npl_fc_r_sa_trm  |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+----------------------------------------------------------------
npl_fc_r_sa_trm  |
             L1. |   .9436222   .0357243    26.41   0.000     .8736038    1.013641
                 |
       gdp_l_sa  |
             L3. |  -7.938223   3.443929    -2.30   0.021     -14.6882   -1.188247
                 |
         ex_a_sa |    3.92236   2.443146     1.61   0.108    -.8661178    8.710838
                 |
          cpi_sa |
             L3. |   3.562493   2.207329     1.61   0.107    -.7637926    7.888778
                 |
            i_sa |
             L3. |   -.127095   .0532226    -2.39   0.017    -.2314093   -.0227807
                 |
cap_inf_l_sa_trm |   1.682495   .7076543     2.38   0.017     .2955179    3.069472
                 |
          tot_sa |
             L3. |  -1.102814   .7090506    -1.56   0.120    -2.492527    .2869001
                 |
    fis_exp_l_sa |
             L6. |   .9430469    .551726     1.71   0.087    -.1383161     2.02441
                 |
      size_sh_sa |  -.0469313   .0252444    -1.86   0.063    -.0964094    .0025468
           _cons |   44.57777   27.51106     1.62   0.105    -9.342923    98.49846
----------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa
    L3.cpi_sa L3.i_sa size_sh_sa)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/194).(L2.npl_fc_r_sa_trm L3.npl_fc_r_sa_trm L4.npl_fc_r_sa_trm)
    collapsed
Instruments for levels equation
  Standard
    cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa
    L3.i_sa size_sh_sa
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L2.npl_fc_r_sa_trm L3.npl_fc_r_sa_trm L4.npl_fc_r_sa_trm) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.36  Pr > z =  0.018
Arellano-Bond test for AR(2) in first differences: z =   0.09  Pr > z =  0.930
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(192)  = 411.73  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(192)  =   5.53  Prob > chi2 =  1.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(189)  =   5.04  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(3)    =   0.48  Prob > chi2 =  0.922
  iv(cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa L3.i_sa size_sh_sa)
    Hansen test excluding group:     chi2(184)  =   6.86  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(8)    =  -1.33  Prob > chi2 =  1.000

.
```

3.4 Foreign currency NPLS fixed effects estimation results for all banks

```
Fixed-effects (within) regression               Number of obs      =      1534
Group variable: id                              Number of groups   =        14

R-sq:  within  = 0.8919                         Obs per group: min =        30
       between = 0.9945                                        avg =     109.6
       overall = 0.9211                                        max =       151

                                                F(9,1511)          =   1385.45
corr(u_i, Xb)  = 0.2263                         Prob > F           =    0.0000

------------------------------------------------------------------------------
npl_fc_r_sa_trm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------------+-------------------------------------------------------------
npl_fc_r_sa_trm |
            L1. |   .9394063   .0089723   104.70   0.000     .9218069    .9570058
                |
       gdp_l_sa |
            L3. |  -6.700814   2.630873    -2.55   0.011    -11.86136   -1.540264
                |
        ex_a_sa |   3.211367   1.470282     2.18   0.029     .3273576    6.095376
                |
         cpi_sa |
            L3. |   3.508367   2.755491     1.27   0.203    -1.896625    8.913359
                |
           i_sa |
            L3. |  -.1092976   .0625717    -1.75   0.081    -.2320343     .013439
                |
cap_inf_l_sa_trm|    1.31067   .7484296     1.75   0.080    -.1574013    2.778741
                |
         tot_sa |
            L3. |  -1.563338   .8830225    -1.77   0.077    -3.295418    .1687414
                |
    fis_exp_l_sa |
            L6. |   .8755201   .6749539     1.30   0.195    -.4484258    2.199466
                |
     size_sh_sa |  -.0922171   .0753881    -1.22   0.221    -.2400936    .0556594
          _cons |   38.94451   26.44055     1.47   0.141    -12.91955    90.80857
----------------+-------------------------------------------------------------
        sigma_u |  .95259427
        sigma_e |  5.3376209
            rho |  .03086765   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(13, 1511) =     2.16            Prob > F = 0.0091
```

3.5 Total NPLS system GMM estimation results for all banks

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1255
Time variable : t                               Number of groups   =        14
Number of instruments = 202                     Obs per group: min =        33
Wald chi2(10) =   4308.55                                      avg =     89.64
Prob > chi2   =     0.000                                      max =       121
--------------------------------------------------------------------------------
               |              Robust
  npl_r_sa_trm |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
  npl_r_sa_trm |
           L1. |   .8157427   .0626959    13.01   0.000     .6928609    .9386245
               |
     gdp_l_sa  |
           L3. |  -4.401255   2.033975    -2.16   0.030    -8.387772   -.4147381
               |
       ex_a_sa |   3.032255   1.555977     1.95   0.051    -.0174052    6.081914
               |
        cpi_sa |
           L3. |   1.437072   1.664329     0.86   0.388    -1.824953    4.699096
               |
          i_sa |
           L3. |  -.0638653   .0429044    -1.49   0.137    -.1479564    .0202258
               |
cap_inf_l_sa~m |
           --. |   1.757373   .7842902     2.24   0.025     .2201923    3.294553
           L6. |  -.4145285   .2755005    -1.50   0.132    -.9544996    .1254427
               |
        tot_sa |
           L3. |  -.7042552   .6037322    -1.17   0.243    -1.887549    .4790383
               |
  fis_exp_l_sa |
           L6. |   .4911604   .5517406     0.89   0.373    -.5902314    1.572552
               |
    size_sh_sa |  -.0481601   .0256432    -1.88   0.060    -.0984198    .0020996
         _cons |    20.2791   15.87844     1.28   0.202    -10.84208    51.40028
--------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa
    L3.cpi_sa L3.i_sa size_sh_sa L6.cap_inf_l_sa_trm)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/194).(L2.npl_r_sa_trm L3.npl_r_sa_trm L4.npl_r_sa_trm) collapsed
Instruments for levels equation
  Standard
    cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa
    L3.i_sa size_sh_sa L6.cap_inf_l_sa_trm
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L2.npl_r_sa_trm L3.npl_r_sa_trm L4.npl_r_sa_trm) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.95  Pr > z =  0.051
Arellano-Bond test for AR(2) in first differences: z =  -0.78  Pr > z =  0.434
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(191)  = 300.05  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(191)  =   3.41  Prob > chi2 =  1.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(188)  =   1.84  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(3)    =   1.57  Prob > chi2 =  0.666
  iv(cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa L3.
> i_sa size_sh_sa L6.cap_inf_l_sa_trm)
    Hansen test excluding group:     chi2(182)  =   0.72  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(9)    =   2.69  Prob > chi2 =  0.975
```

3.6 Total NPLS fixed effects estimation results for all banks

```
Fixed-effects (within) regression               Number of obs      =      1255
Group variable: id                              Number of groups   =        14

R-sq:  within  = 0.8303                         Obs per group: min =        33
       between = 0.9967                                        avg =      89.6
       overall = 0.8873                                        max =       121

                                                F(10,1231)         =    602.45
corr(u_i, Xb)  = 0.4798                         Prob > F           =    0.0000

------------------------------------------------------------------------------
  npl_r_sa_trm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------+--------------------------------------------------------------
  npl_r_sa_trm |
           L1. |   .9108871   .0122983    74.07   0.000     .8867591    .9350152
               |
      gdp_l_sa |
           L3. |  -3.783407   1.293184    -2.93   0.004    -6.320494   -1.246319
               |
       ex_a_sa |   2.655536   .8316423     3.19   0.001     1.023943    4.287129
               |
        cpi_sa |
           L3. |   .6061425   1.271329     0.48   0.634    -1.888068    3.100353
               |
          i_sa |
           L3. |  -.0550391   .0290402    -1.90   0.058    -.1120129    .0019347
               |
cap_inf_l_sa~m |
           --. |   1.645823   .3765071     4.37   0.000     .9071564    2.384489
           L6. |  -.2031681   .3389249    -0.60   0.549    -.8681025    .4617663
               |
        tot_sa |
           L3. |  -.7862542   .4108229    -1.91   0.056    -1.592245    .0197363
               |
    fis_exp_l_sa |
           L6. |   .6917507   .3354115     2.06   0.039     .0337093    1.349792
               |
    size_sh_sa |  -.0223538   .0359988    -0.62   0.535    -.0929795    .0482719
         _cons |   12.88615   12.41169     1.04   0.299    -11.46426    37.23656
---------------+--------------------------------------------------------------
       sigma_u |  .39766313
       sigma_e |  2.2147907
           rho |  .03123097   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(13, 1231) =     1.85             Prob > F = 0.0313

.
```

3.7 Domestic currency NPLS system GMM estimation results for big banks

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =       496
Time variable : t                               Number of groups   =         4
Number of instruments = 200                     Obs per group: min =        86
Wald chi2(9)  =     29.18                                      avg =    124.00
Prob > chi2   =     0.001                                      max =       143
```

npl_dc_r_sa_trm	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
npl_dc_r_sa_trm						
L1.	.5551179	.0954317	5.82	0.000	.3680752	.7421606
gdp_l_sa						
L3.	-1.581867	.9461724	-1.67	0.095	-3.436331	.2725964
ex_a_sa	6.46468	1.984573	3.26	0.001	2.574988	10.35437
cpi_sa						
L3.	-1.739079	1.627635	-1.07	0.285	-4.929185	1.451027
i_sa						
L3.	-.0808617	.045235	-1.79	0.074	-.1695206	.0077973
cap_inf_l_sa_trm						
L6.	-.0112251	.1094037	-0.10	0.918	-.2256524	.2032023
tot_sa						
L3.	-.4445706	.8522185	-0.52	0.602	-2.114888	1.225747
fis_exp_l_sa						
L6.	-.3189638	.3789474	-0.84	0.400	-1.061687	.4237595
size_sh_sa	-.0156925	.0414229	-0.38	0.705	-.09688	.0654949
_cons	-6.91297	15.93647	-0.43	0.664	-38.14787	24.32193

```
Instruments for first differences equation
  Standard
    D.(L6.cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa
    L3.cpi_sa L3.i_sa size_sh_sa)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/194).(L2.npl_dc_r_sa_trm L3.npl_dc_r_sa_trm) collapsed
Instruments for levels equation
  Standard
    L6.cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa
    L3.cpi_sa L3.i_sa size_sh_sa
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L2.npl_dc_r_sa_trm L3.npl_dc_r_sa_trm) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.44  Pr > z =  0.150
Arellano-Bond test for AR(2) in first differences: z =  -1.53  Pr > z =  0.125
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(190)  = 298.23  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(190)  =   0.00  Prob > chi2 =  1.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(188)  =   0.00  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(2)    =  -0.00  Prob > chi2 =  1.000
  iv(L6.cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa L3.
> i_sa size_sh_sa)
    Hansen test excluding group:     chi2(182)  =   0.00  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(8)    =  -0.00  Prob > chi2 =  1.000
```

3.8 Domestic currency NPLS fixed effects estimation results for big banks

```
Fixed-effects (within) regression               Number of obs      =       496
Group variable: id                              Number of groups   =         4

R-sq:  within  = 0.8893                         Obs per group: min =        86
       between = 0.9851                                        avg =     124.0
       overall = 0.9015                                        max =       143

                                                F(9,483)           =    431.32
corr(u_i, Xb)  = 0.1879                         Prob > F           =    0.0000
```

npl_dc_r_sa_trm	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
npl_dc_r_sa_trm L1.	.8741788	.018517	47.21	0.000	.8377951	.9105626
gdp_l_sa L3.	-1.980349	.9875961	-2.01	0.045	-3.920864	-.0398332
ex_a_sa	1.679206	.6527459	2.57	0.010	.3966339	2.961779
cpi_sa L3.	1.255673	1.046968	1.20	0.231	-.8015011	3.312848
i_sa L3.	-.0348699	.0228662	-1.52	0.128	-.0797994	.0100596
cap_inf_l_sa_trm L6.	-.0344267	.2722246	-0.13	0.899	-.5693176	.5004641
tot_sa L3.	-.1168179	.3381489	-0.35	0.730	-.7812425	.5476067
fis_exp_l_sa L6.	-.0818157	.278685	-0.29	0.769	-.6294005	.465769
size_sh_sa	-.0184958	.0228813	-0.81	0.419	-.063455	.0264634
_cons	13.2023	9.940438	1.33	0.185	-6.329542	32.73415
sigma_u	.20159475					
sigma_e	1.1377529					
rho	.03043949	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(3, 483) =     1.75              Prob > F = 0.1551
```

.

3.9 Foreign currency NPLS system GMM estimation results for big banks

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =       586
Time variable : t                               Number of groups   =         4
Number of instruments = 202                     Obs per group: min =       142
Wald chi2(9)  =     11.11                                      avg =    146.50
Prob > chi2   =     0.269                                      max =       151
----------------------------------------------------------------------------------
                 |              Robust
npl_fc_r_sa_trm  |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+----------------------------------------------------------------
npl_fc_r_sa_trm  |
             L1. |   .8027341   .0686133    11.70   0.000     .6682545    .9372137
                 |
       gdp_l_sa  |
             L3. |  -1.794611   3.483736    -0.52   0.606    -8.622608    5.033385
                 |
        ex_a_sa  |    2.53197   1.505618     1.68   0.093    -.4189867    5.482927
                 |
         cpi_sa  |
             L3. |   1.947826   3.080802     0.63   0.527    -4.090436    7.986087
                 |
           i_sa  |
             L3. |  -.0618648   .0772412    -0.80   0.423    -.2132547    .0895251
                 |
cap_inf_l_sa_trm |   .2439514    .547506     0.45   0.656    -.8291405    1.317043
                 |
         tot_sa  |
             L3. |  -1.550432   .3716698    -4.17   0.000    -2.278891   -.8219726
                 |
    fis_exp_l_sa |
             L6. |  -.0947524   .1652577    -0.57   0.566    -.4186516    .2291469
                 |
      size_sh_sa |   .0761849   .0095343     7.99   0.000      .057498    .0948717
           _cons |   5.722764   32.39569     0.18   0.860    -57.77162    69.21715
----------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa
    L3.cpi_sa L3.i_sa size_sh_sa)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/194).(L2.npl_fc_r_sa_trm L3.npl_fc_r_sa_trm L4.npl_fc_r_sa_trm)
    collapsed
Instruments for levels equation
  Standard
    cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa
    L3.i_sa size_sh_sa
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L2.npl_fc_r_sa_trm L3.npl_fc_r_sa_trm L4.npl_fc_r_sa_trm) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.56  Pr > z =  0.120
Arellano-Bond test for AR(2) in first differences: z =  -1.44  Pr > z =  0.151
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(192)  = 316.25  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(192)  =   0.00  Prob > chi2 =  1.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(189)  =   0.00  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(3)    =  -0.00  Prob > chi2 =  1.000
  iv(cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa L3.i_s
> a size_sh_sa)
    Hansen test excluding group:     chi2(184)  =   0.00  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(8)    =   0.00  Prob > chi2 =  1.000

.
```

3.10 Foreign currency NPLS fixed effects estimation results for big banks

```
Fixed-effects (within) regression               Number of obs      =       586
Group variable: id                              Number of groups   =         4

R-sq:  within  = 0.8710                         Obs per group: min =       142
       between = 0.9995                                        avg =     146.5
       overall = 0.8818                                        max =       151

                                                F(9,573)           =    429.84
corr(u_i, Xb)  = 0.3308                         Prob > F           =    0.0000
```

npl_fc_r_sa_trm	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
npl_fc_r_sa_trm L1.	.9014227	.0192338	46.87	0.000	.8636453	.9392002
gdp_l_sa L3.	-1.16157	1.625597	-0.71	0.475	-4.354424	2.031285
ex_a_sa	1.413504	.9263587	1.53	0.128	-.4059684	3.232977
cpi_sa L3.	1.283067	1.669021	0.77	0.442	-1.995078	4.561212
i_sa L3.	-.0276924	.0384159	-0.72	0.471	-.1031456	.0477608
cap_inf_l_sa_trm	.5245216	.4433647	1.18	0.237	-.3462967	1.39534
tot_sa L3.	-1.076274	.5325392	-2.02	0.044	-2.12224	-.0303066
fis_exp_l_sa L6.	.0301467	.4165674	0.07	0.942	-.7880386	.848332
size_sh_sa	-.0446621	.0408231	-1.09	0.274	-.1248434	.0355191
_cons	3.159984	16.18513	0.20	0.845	-28.62943	34.9494
sigma_u	.78471404					
sigma_e	2.0070106					
rho	.13259984	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(3, 573) =     3.63              Prob > F = 0.0129

.
```

3.11 Total NPLS system GMM estimation results for big banks

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =       392
Time variable : t                               Number of groups   =         4
Number of instruments = 195                     Obs per group: min =        58
Wald chi2(10) =     40.46                                      avg =     98.00
Prob > chi2   =     0.000                                      max =       121
----------------------------------------------------------------------------------
                 |              Robust
    npl_r_sa_trm |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+----------------------------------------------------------------
    npl_r_sa_trm |
             L1. |   .5843974   .1212266     4.82   0.000     .3467977    .8219972
                 |
        gdp_l_sa |
             L3. |   .0460282   2.434607     0.02   0.985    -4.725713    4.817769
                 |
         ex_a_sa |   6.509436   1.506635     4.32   0.000     3.556486    9.462386
                 |
          cpi_sa |
             L3. |  -2.143301    2.22874    -0.96   0.336    -6.511552     2.22495
                 |
            i_sa |
             L3. |   .0150302   .0276536     0.54   0.587    -.0391698    .0692302
                 |
cap_inf_l_sa_trm |
             --. |   .6114757   .4011569     1.52   0.127    -.1747775    1.397729
             L6. |   .3011396   .2170912     1.39   0.165    -.1243514    .7266305
                 |
          tot_sa |
             L3. |  -.8673196   .5465019    -1.59   0.113    -1.938444    .2038045
                 |
    fis_exp_l_sa |
             L6. |  -.5691653   .3775705    -1.51   0.132     -1.30919    .1708593
                 |
      size_sh_sa |   .0054882   .0308059     0.18   0.859    -.0548903    .0658667
           _cons |  -28.15168   24.75931    -1.14   0.256    -76.67903    20.37567
----------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa
    L3.cpi_sa L3.i_sa size_sh_sa L6.cap_inf_l_sa_trm)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/194).(L2.npl_r_sa_trm L3.npl_r_sa_trm L4.npl_r_sa_trm) collapsed
Instruments for levels equation
  Standard
    cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa
    L3.i_sa size_sh_sa L6.cap_inf_l_sa_trm
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L2.npl_r_sa_trm L3.npl_r_sa_trm L4.npl_r_sa_trm) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.24  Pr > z =  0.215
Arellano-Bond test for AR(2) in first differences: z =  -1.10  Pr > z =  0.271
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(184)  = 266.71  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(184)  =   0.00  Prob > chi2 =  1.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(181)  =   0.00  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(3)    =   0.00  Prob > chi2 =  1.000
  iv(cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa L3.i_s
> a size_sh_sa L6.cap_inf_l_sa_trm)
    Hansen test excluding group:     chi2(175)  =   0.00  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(9)    =   0.00  Prob > chi2 =  1.000


.
```

3.12 Total NPLS fixed effects estimation results for big banks

```
Fixed-effects (within) regression               Number of obs      =       392
Group variable: id                              Number of groups   =         4

R-sq:  within  = 0.9153                         Obs per group: min =        58
       between = 0.9540                                        avg =      98.0
       overall = 0.9195                                        max =       121

                                                F(10,378)          =    408.42
corr(u_i, Xb)  = 0.0788                         Prob > F           =    0.0000

------------------------------------------------------------------------------------
    npl_r_sa_trm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------+------------------------------------------------------------------
    npl_r_sa_trm |
             L1. |   .9000658   .0212306    42.39   0.000     .8583209    .9418106
                 |
        gdp_l_sa |
             L3. |  -.1751936   .9021824    -0.19   0.846    -1.949118    1.598731
                 |
         ex_a_sa |   1.724923   .6670099     2.59   0.010     .4134083    3.036438
                 |
          cpi_sa |
             L3. |   -.228003   .9069143    -0.25   0.802    -2.011232    1.555226
                 |
            i_sa |
             L3. |   .0145626   .0210749     0.69   0.490    -.0268761    .0560014
                 |
cap_inf_l_sa_trm |
             --. |   .4876237   .2620019     1.86   0.063      -.02754    1.002787
             L6. |   .1988536   .2366884     0.84   0.401    -.2665373    .6642445
                 |
          tot_sa |
             L3. |   -.469359   .3059365    -1.53   0.126     -1.07091    .1321915
                 |
      fis_exp_l_sa |
             L6. |  -.1332119   .2454621    -0.54   0.588    -.6158542    .3494304
                 |
      size_sh_sa |  -.0144889   .0204759    -0.71   0.480    -.0547498     .025772
           _cons |  -8.069225   8.684187    -0.93   0.353    -25.14459    9.006141
-----------------+------------------------------------------------------------------
         sigma_u |  .21497208
         sigma_e |  .88682537
             rho |  .05549963   (fraction of variance due to u_i)
------------------------------------------------------------------------------------
F test that all u_i=0:     F(3, 378) =     1.63             Prob > F = 0.1816

.
```

3.13 Domestic currency NPLS system GMM estimation results for other banks

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =       796
Time variable : t                               Number of groups   =         7
Number of instruments = 200                     Obs per group: min =        37
Wald chi2(9)  =    303.35                                      avg =    113.71
Prob > chi2   =     0.000                                      max =       151
------------------------------------------------------------------------------
                 |               Robust
 npl_dc_r_sa_trm |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+----------------------------------------------------------------
 npl_dc_r_sa_trm |
             L1. |   .7888661    .097295     8.11   0.000     .5981715    .9795608
                 |
        gdp_l_sa |
             L3. |  -8.537774   3.577426    -2.39   0.017     -15.5494   -1.526147
                 |
         ex_a_sa |   1.446949   1.294726     1.12   0.264    -1.090668    3.984565
                 |
          cpi_sa |
             L3. |   6.033716    3.06593     1.97   0.049     .0246035    12.04283
                 |
            i_sa |
             L3. |  -.0679977   .0357964    -1.90   0.057    -.1381573    .0021619
                 |
cap_inf_l_sa_trm |
             L6. |  -.5647487   .1683264    -3.36   0.001    -.8946623    -.234835
                 |
          tot_sa |
             L3. |   -.701261   1.160188    -0.60   0.546    -2.975187    1.572665
                 |
    fis_exp_l_sa |
             L6. |   .5973384   .6394838     0.93   0.350    -.6560268    1.850704
                 |
      size_sh_sa |  -.2361351   .1979268    -1.19   0.233    -.6240645    .1517943
           _cons |   79.42926   41.26885     1.92   0.054    -1.456195    160.3147
----------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(L6.cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa
    L3.cpi_sa L3.i_sa size_sh_sa)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/194).(L2.npl_dc_r_sa_trm L3.npl_dc_r_sa_trm) collapsed
Instruments for levels equation
  Standard
    L6.cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa
    L3.cpi_sa L3.i_sa size_sh_sa
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L2.npl_dc_r_sa_trm L3.npl_dc_r_sa_trm) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.18  Pr > z =  0.029
Arellano-Bond test for AR(2) in first differences: z =  -0.76  Pr > z =  0.449
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(190)  = 168.71  Prob > chi2 =  0.865
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(190)  =   0.00  Prob > chi2 =  1.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(188)  =   0.00  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(2)    =  -0.00  Prob > chi2 =  1.000
  iv(L6.cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa L3
> .i_sa size_sh_sa)
    Hansen test excluding group:     chi2(182)  =   0.00  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(8)    =   0.00  Prob > chi2 =  1.000
```

3.14 Domestic currency NPLS fixed effects estimation results for other banks

```
Fixed-effects (within) regression               Number of obs      =       796
Group variable: id                              Number of groups   =         7

R-sq:  within  = 0.8217                         Obs per group: min =        37
       between = 0.9963                                        avg =     113.7
       overall = 0.8888                                        max =       151

                                                F(9,780)           =    399.28
corr(u_i, Xb)  = 0.5534                         Prob > F           =    0.0000
```

npl_dc_r_sa_trm	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
npl_dc_r_sa_trm						
L1.	.8987115	.0156979	57.25	0.000	.8678964	.9295266
gdp_l_sa						
L3.	-6.568402	1.829665	-3.59	0.000	-10.16005	-2.976752
ex_a_sa	.8003085	1.040508	0.77	0.442	-1.24222	2.842837
cpi_sa						
L3.	5.055098	1.902055	2.66	0.008	1.321345	8.788852
i_sa						
L3.	-.0396633	.0401547	-0.99	0.324	-.1184873	.0391607
cap_inf_l_sa_trm						
L6.	-.1491882	.4959825	-0.30	0.764	-1.122807	.8244304
tot_sa						
L3.	-.1947325	.5833052	-0.33	0.739	-1.339766	.9503016
fis_exp_l_sa						
L6.	.3497134	.4822319	0.73	0.469	-.5969127	1.296339
size_sh_sa	-.0889119	.110475	-0.80	0.421	-.3057754	.1279517
_cons	59.64429	18.54661	3.22	0.001	23.2371	96.05148
sigma_u	.51693504					
sigma_e	2.5479505					
rho	.03953411	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(6, 780) =     2.92             Prob > F = 0.0081
```

.

3.15 Foreign currency NPLS system GMM estimation results for other banks

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =       743
Time variable : t                               Number of groups   =         7
Number of instruments = 201                     Obs per group: min =        39
Wald chi2(9)  =    421.53                                      avg =    106.14
Prob > chi2   =     0.000                                      max =       149
```

npl_fc_r_sa_trm	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
npl_fc_r_sa_trm						
L1.	.9484596	.0389663	24.34	0.000	.8720871	1.024832
gdp_l_sa						
L3.	-12.61967	4.849996	-2.60	0.009	-22.12549	-3.11385
ex_a_sa	3.292333	2.409437	1.37	0.172	-1.430077	8.014742
cpi_sa						
L3.	8.730908	2.922913	2.99	0.003	3.002103	14.45971
i_sa						
L3.	-.2182648	.0846053	-2.58	0.010	-.3840882	-.0524414
cap_inf_l_sa_trm	1.744756	.9953601	1.75	0.080	-.2061141	3.695626
tot_sa						
L3.	-1.907223	1.063183	-1.79	0.073	-3.991023	.1765774
fis_exp_l_sa						
L6.	.839686	.9401614	0.89	0.372	-1.002996	2.682368
size_sh_sa	-.2378306	.1161313	-2.05	0.041	-.4654437	-.0102174
_cons	98.52788	39.44156	2.50	0.012	21.22385	175.8319

```
Instruments for first differences equation
  Standard
    D.(cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa
    L3.cpi_sa L3.i_sa size_sh_sa)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/194).(L2.npl_fc_r_sa_trm L3.npl_fc_r_sa_trm L4.npl_fc_r_sa_trm)
    collapsed
Instruments for levels equation
  Standard
    cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa
    L3.i_sa size_sh_sa
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L2.npl_fc_r_sa_trm L3.npl_fc_r_sa_trm L4.npl_fc_r_sa_trm) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.80  Pr > z =  0.072
Arellano-Bond test for AR(2) in first differences: z =  -0.25  Pr > z =  0.802
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(191)  = 267.93  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(191)  =   0.00  Prob > chi2 =  1.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(188)  =   0.00  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(3)    =   0.00  Prob > chi2 =  1.000
  iv(cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa L3.i_
> sa size_sh_sa)
    Hansen test excluding group:     chi2(183)  =   0.00  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(8)    =   0.00  Prob > chi2 =  1.000
```

3.16 Foreign currency NPLS fixed effects estimation results for other banks

```
Fixed-effects (within) regression               Number of obs      =       743
Group variable: id                              Number of groups   =         7

R-sq:  within  = 0.9020                         Obs per group: min =        39
       between = 0.9952                                        avg =     106.1
       overall = 0.9265                                        max =       149

                                                F(9,727)           =    743.78
corr(u_i, Xb)  = 0.2600                         Prob > F           =    0.0000
```

npl_fc_r_sa_trm	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
npl_fc_r_sa_trm						
L1.	.9491044	.0132199	71.79	0.000	.9231507	.9750581
gdp_l_sa						
L3.	-12.80942	4.514309	-2.84	0.005	-21.67206	-3.946786
ex_a_sa	2.511779	2.54278	0.99	0.324	-2.480288	7.503847
cpi_sa						
L3.	8.255295	4.633862	1.78	0.075	-.8420525	17.35264
i_sa						
L3.	-.2103402	.101805	-2.07	0.039	-.4102071	-.0104734
cap_inf_l_sa_trm	1.608627	1.275274	1.26	0.208	-.895033	4.112287
tot_sa						
L3.	-2.794482	1.478546	-1.89	0.059	-5.697211	.108247
fis_exp_l_sa						
L6.	1.594557	1.107402	1.44	0.150	-.579531	3.768644
size_sh_sa	-.2795745	.2309726	-1.21	0.227	-.7330275	.1738784
_cons	99.05923	45.63447	2.17	0.030	9.468169	188.6503
sigma_u	.99968663					
sigma_e	6.1323387					
rho	.02588718	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(6, 727) =     1.77               Prob > F = 0.1026
```

.

3.17 Total NPLS system GMM estimation results for other banks

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =       661
Time variable : t                               Number of groups   =         7
Number of instruments = 200                     Obs per group: min =        33
Wald chi2(10) =     29.36                                      avg =     94.43
Prob > chi2   =     0.001                                      max =       121
----------------------------------------------------------------------------------
                 |               Robust
     npl_r_sa_trm |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+----------------------------------------------------------------
     npl_r_sa_trm |
              L1. |   .8168989   .0669254    12.21   0.000     .6857275    .9480703
                 |
        gdp_l_sa |
              L3. |  -5.200084   3.349547    -1.55   0.121    -11.76508    1.364907
                 |
         ex_a_sa |   3.089106   2.356072     1.31   0.190     -1.52871    7.706921
                 |
          cpi_sa |
              L3. |   2.762267   2.911757     0.95   0.343    -2.944672    8.469205
                 |
            i_sa |
              L3. |  -.1002799   .0857279    -1.17   0.242    -.2683036    .0677438
                 |
cap_inf_l_sa_trm |
              --. |   2.451345   1.284771     1.91   0.056    -.0667597     4.96945
              L6. |  -.2133878   .2469794    -0.86   0.388    -.6974586     .270683
                 |
          tot_sa |
              L3. |  -1.752092   1.088025    -1.61   0.107    -3.884582    .3803982
                 |
     fis_exp_l_sa |
              L6. |   .2822408   .6957098     0.41   0.685    -1.081325    1.645807
                 |
      size_sh_sa |  -.2195692   .2019477    -1.09   0.277    -.6153794    .1762411
           _cons |   29.51666   29.41612     1.00   0.316    -28.13788    87.17121
----------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa
    L3.cpi_sa L3.i_sa size_sh_sa L6.cap_inf_l_sa_trm)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/194).(L2.npl_r_sa_trm L3.npl_r_sa_trm L4.npl_r_sa_trm) collapsed
Instruments for levels equation
  Standard
    cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa
    L3.i_sa size_sh_sa L6.cap_inf_l_sa_trm
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L2.npl_r_sa_trm L3.npl_r_sa_trm L4.npl_r_sa_trm) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.45  Pr > z =  0.148
Arellano-Bond test for AR(2) in first differences: z =   0.39  Pr > z =  0.695
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(189)  = 267.39  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(189)  =   0.00  Prob > chi2 =  1.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(186)  =   0.00  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(3)    =   0.00  Prob > chi2 =  1.000
  iv(cap_inf_l_sa_trm L3.tot_sa L6.fis_exp_l_sa ex_a_sa L3.gdp_l_sa L3.cpi_sa L3.i_
> sa size_sh_sa L6.cap_inf_l_sa_trm)
    Hansen test excluding group:     chi2(180)  =   0.00  Prob > chi2 =  1.000
    Difference (null H = exogenous): chi2(9)    =   0.00  Prob > chi2 =  1.000
```

3.18 Total NPLS fixed effects estimation results for other banks

```
Fixed-effects (within) regression               Number of obs      =       661
Group variable: id                              Number of groups   =         7

R-sq:  within  = 0.8215                         Obs per group: min =        33
       between = 0.9964                                        avg =      94.4
       overall = 0.8900                                        max =       121

                                                F(10,644)          =    296.37
corr(u_i, Xb)  = 0.5559                         Prob > F           =    0.0000
```

npl_r_sa_trm	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
npl_r_sa_trm						
L1.	.8933283	.0183489	48.69	0.000	.8572974	.9293591
gdp_l_sa						
L3.	-5.251559	2.013056	-2.61	0.009	-9.204505	-1.298613
ex_a_sa	3.48428	1.272927	2.74	0.006	.9846904	5.983869
cpi_sa						
L3.	1.633045	1.961937	0.83	0.406	-2.219521	5.485611
i_sa						
L3.	-.0810982	.0438411	-1.85	0.065	-.167187	.0049906
cap_inf_l_sa_trm						
--.	2.693884	.583979	4.61	0.000	1.547151	3.840617
L6.	.1061972	.5206298	0.20	0.838	-.9161397	1.128534
tot_sa						
L3.	-1.310306	.619218	-2.12	0.035	-2.526237	-.0943762
fis_exp_l_sa						
L6.	.5494151	.5049811	1.09	0.277	-.4421934	1.541024
size_sh_sa	-.0899759	.1025934	-0.88	0.381	-.2914339	.111482
_cons	20.29382	19.63694	1.03	0.302	-18.26635	58.85399
sigma_u	.55374513					
sigma_e	2.4266546					
rho	.04949467	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(6, 644) =     2.88             Prob > F = 0.0090
```